vancement of education and knowledge, we extend to them a hearty welcome."

It is plain from these resolutions that the clergy of these most orthodox, most order-loving, and church-going cities are not afraid of their scientific brethren. They have even gone a step further, and they extend to the members of the American Association for the Advancement of Science a cordial invitation to occupy so far as possible the pulpits of their churches on the morning and evening of June 29. It is sincerely hoped that this invitation will he heeded and that a number of the members of the Association will avail themselves of the opportunity to present to the large and intelligent audiences, which will greet them, such phases of scientific truth as may be appropriately presented before worshiping assemblies. As Chairman of the Local Executive Committee charged with making arrangements for the coming meeting, and on behalf of the clergy of the city, I desire by special request to urge those who are coming to the meeting to bring with them addresses of such a character as they may feel inclined to present, and if they will notify me in advance—which I hope they will do—of their willingness to address such audiences, we will arrange with the clergy for the assignment of such speakers to various pulpits. Scientific men as well as clergymen have 'barrels,' and I trust that not a few will open up their barrels before coming to the meeting and bring with them from their treasure houses 'things new and old' which the good people of these cities will be glad to hear.

W. J. Holland.

SHORTER ARTICLES.

HENRI FILHOL, PALEONTOLOGIST.

By the death of Henri Filhol, French paleontology has suffered a severe loss. As a successor of the school of de Blainville and contemporary of Professor Albert Gaudry, he has rendered distinguished service, especially in his originality as an explorer of the famous deposits of the Phosporites du Quercy, terminating in his volumes published in 1877, and of the Upper Oligocene, Saint-Gérand le Puy, published in 1879. Continuing this line of research he explored the Lower Oligocene of Ronzon, publishing his results in 1880. These larger volumes together with several memoirs and a very numerous series of preliminary papers have greatly enriched our knowledge, especially of the Oligocene fossil fauna of France.

One of the most important of his discoveries was a complete skeleton of the genus *Macrotherium*, formerly established upon the claws, proving that this animal was identical with the genus *Chalicotherium*, which had been established upon the teeth. It was thus found to represent an extraordinary combination of dentition affiliated to that of the ungulates, and feet apparently affiliated to those of the edentates. M. Filhol himself was disposed to regard this animal as a connecting form; but Cope immediately perceived that it represented a new phyla, and proposed for it the name *Ancylopoda*.

During the writer's last visit to Paris, he found M. Filhol devoting his time chiefly to building up a great collection of comparative osteology, which had been almost entirely neglected since the time of Cuvier. M. Filhol expressed his purpose as follows: 'I had found it impossible to study comparative osteology in the disordered state of the collections, and I determined that I would devote my time to an entire rearrangement, so that students coming to Paris would enjoy opportunities which had been denied me.' The beautifully arranged hall, presenting all the remarkable variations, especially of the mammalian skeleton, will therefore be the monument of M. Filhol's later years.

The superb collections of fossils which he made will, it is hoped, soon be acquired by the state and placed on exhibition in the famous gallery of paleontology in the Museum of the Jardin des Plantes.

H. F. O.

CERTAIN PROPERTIES OF NUCLEI.

In an extended series of experiments, made by shaking dilute solutions of the order of 1 per cent., .01 per cent., .0001 per cent. by weight, and a variety of solutes like HCl,

H_2SO_4, NaCl, $CaCl_2$, $FeCl_3$, $Fe3NO_3$, $Al3NO_3$, $Ca2NO_3$, $(H_4N)NO_3$, alum, Na_2SO_4, etc., and neutral organic bodies like sucrose, glucose, glycerine, urea, etc., I reached a number of new results, to one of which, in particular, I will venture to call attention here.

1. The number of nuclei produced under identical conditions of agitation varies with the violence of the agitation and the bulk of solution used, and from a theoretical point of view, particularly with the concentration of the solution and its chemical nature. Thus under given identical conditions of shaking one may get from water about 30 nuclei per cubic centimeter; from 1 per cent. $CaCl_2$ solution, 240 nuclei; from 1 per cent. Na_2SO_4 solution, 450 nuclei, etc.; from 2 per cent. sugar solution, 157 nuclei; from 2.6 per cent. glycerine solution, 95 nuclei, etc. So far as concentration alone goes, one may write for dilute solutions, $n = n_0 + A/(\log(B/C))$, where n is the number of nuclei produced per cu. cm. under otherwise like conditions, n_0 the number in case of infinite dilution (water), C the concentration and A and B constants. If absolutely pure water were available, it is probable that n_0 would vanish. One may note that the degrees of extreme dilution effective recall the sensitiveness of electrolytic experiments. For organic neutral solutes, the number of nuclei is not only smaller as a rule, but they are characteristically fleeting.

2. The point with which I am concerned, however, is the rate at which the nuclei vanish in the lapse of time. From the marked diffusion of these nuclei, their dimensions must be comparable with molecular dimensions. Subsidence is out of the question. If, as I interpret it, the loss of nuclei in the lapse of time is due to absorption at the solid walls of the spherical receiver, one may write for the absorption velocity, k (meaning that kn nuclei are absorbed per square cm. per minute), $k = -(R/3n)(dn/dt)$. Computing k in this way (essentially $d(\log n)/dt$), one finds from all the solutions, saline or neutral, an important general result: For the case of solutions of a few per cent. (1 to 3), k is of the order of .02 to .04 cm./min., though varying from solute to solute; for the .01 per cent. solutions k is of the mean order of 08 cm./min.; for the .0001 per cent. solutions, k is of mean order of about 8 cm./min.; for ordinary distilled water, in glass vessels, k may reach 5 cm./min., etc. I have the specific data in hand, but do not wish to weary the reader.

It follows therefore in general, that not only does the number of nuclei produced by shaking (*cæt. par.*) increase with the concentration of the dilute solution, but the apparent rate of decay of nuclei diminishes, *i. e.*, their absorption velocity decreases with the strength of the solution. For ordinary distilled water, these velocities, *if referred to three dimensions*, are already beginning to approach the ionic velocities. Again as the number of nuclei, n, is greater, they vanish more slowly, so that an apparent decay increasing with the density of the nucleation is out of the question. The whole, therefore, constitutes an entirely new and striking corroboration of the isolated point of view taken throughout my work.*

3. The inference is therefore tenable that the nuclei shaken out of stronger solutions are larger. Since the nuclei are produced by evaporation from a large diameter, it follows that the dimensions at which evaporation ceases at the surface of the particle are larger for the stronger than for the weaker dilute solutions. Naturally a given degree of concentration is reached in a larger globule in the former case than in the latter. The theory for the production of the nuclei here in question is thus at hand. A particle of absolutely pure water produced by shaking will either vanish by complete evaporation, or it will grow and eventually vanish by subsidence. If, however, the evaporating globule is a solution, the increment of vapor pressure at the surface of increasing convexity will gradually be compensated by the decrement of vapor pressure due to the increasing concentration of the solution. Hence there must be a critical diameter at which the increased vapor pressure due to surface tension just counterbalances the decreased vapor pressure due to concentration. This is the stable diameter of the nucleus. A smaller particle will grow because the concen-

* Compare 'Experiments with Ionized Air,' p. 92, Smithsonian Contributions, Washington, 1891.

tration effect supervenes; a larger particle will evaporate because the effect of surface tension supervenes.

4. In connection with this simple mechanism for producing stable nuclei of a startling degree of smallness by mere shaking, nuclei which may be without electrical charge, the question naturally arises whether the mechanism is not sufficient to account for nuclei in the presence of saturated vapor, in general.

Suppose therefore that such chemically powerful agencies as the X-rays, or Becquerel rays, or ultra-violet light, or the electric glow, etc., on being passed through a saturated vapor, produce in that vapor a new chemical synthesis in degree, however small (fancy the vapor pressure due to a few hundred nuclei per cubic centimeter!), soluble in the liquid from which the vapor arises. Then immediately around the new molecule there will be a region of vanishing vapor pressure. The new molecule (or ion) will therefore grow by condensing the vapor, until further growth is arrested by the decrement of vapor pressure due to diminishing convexity. In other words, the critical diameter is again reached.

C. BARUS.

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QUOTATIONS.

THE APPLICATIONS OF ELECTRICITY IN GREAT BRITAIN.

THE Institution of Electrical Engineers appointed, about a year ago, a committee to inquire into electric legislation and to recommend, if possible, such action as might assist the electrical industry. Some three weeks ago we gave the general conclusions of the committee, as embodied in a number of resolutions. Its report has now been issued, with a large amount of interesting evidence, extracts from which we publish to-day. There are practically no dissentients from the opinion that electrical enterprise is in a very backward condition in this country. The fact may be differently explained by different people, and no doubt, more than one cause may fairly be assigned. There are a few who rather glory in our backwardness, and try to persuade us that other nations have lost money by going ahead. But however the fact may be explained or regarded, it is universally admitted. In the use of electricity for traction, for lighting, and for the economical supply of power for manufacturing purposes, we are far behind other nations. So much is this the case that, when any demand arises for generating machinery and plant, it is found that there has been no previous demand of such a kind as to produce manufacturers with the requisite appliances and experience. An electric railway or tramway company has to import machinery from America or Germany, because it cannot be supplied at home, or, if supplied at all, is produced with extreme slowness. Things are, no doubt, improving in that respect, though it is not altogether agreeable to reflect that the improvement is largely due to American enterprise. The public are mostly concerned in noting the phenomena of traction and lighting. Yet it may be taken as certain that a far greater aggregate loss to the nation arises from the failure to take due advantage of the immense economy in the production and transmission of power that electricity offers when intelligently applied. The committee finds that the main cause of our backwardness is stupid and restrictive legislation, carried out by legislators having no knowledge of the subject they had to deal with, and allowing themselves to be guided by abstract political or economic theories. In other countries rulers called upon to deal with questions of this kind habitually consult men of science and frame their regulations with some regard to the special nature of the subject-matter. In other words, different forms of national intelligence are coordinated for the national good.—The London *Times*.

CURRENT NOTES ON METEOROLOGY.

MONTHLY WEATHER REVIEW.

The Monthly Weather Review for January (issued April 11), the first number of Vol. XXX., is somewhat changed in external appearance, and the name of Mr. H. H. Kimball as assistant editor is associated with that of Professor Abbe. There is a distinct